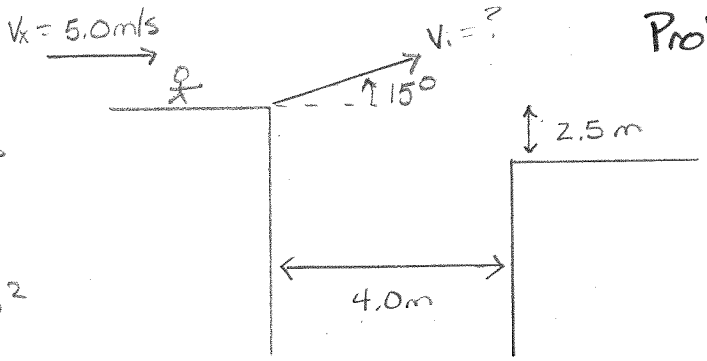
Physics Ch3

Problem Set #2

1) Given:



$V_x = 5.0 m/s$

$\Delta X = 4.0 m$

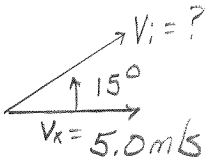
$\Delta y = 2.5 m$

$g = 9.81 m/s^2$

$\emptyset = 15^\circ$

Find: make it to roof?

Soln:



* 1st find V_i

$$V_x = V_i \cos\emptyset$$

$$V_i = \frac{V_x}{\cos\emptyset} = \frac{5.0 m/s}{\cos 15^\circ} = 5.2 m/s$$

* 2nd How long (Δt) to travel 4.0m at V_i

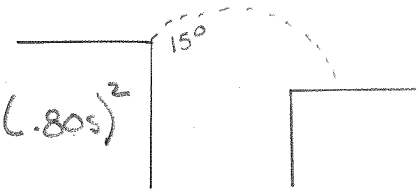
$$\Delta X = V_i \cos\emptyset \, \Delta t \quad \text{solve for } \Delta t$$

$$\Delta t = \frac{\Delta X}{V_i \cos\emptyset} = \frac{4.0 m}{(5.2 m/s)\cos 15^\circ} = .80 s$$

* 3rd How far will he Fall in .80 s

if Δy is greater than 2.5m in .80s he falls toofar

$$\Delta y = V_i \sin\emptyset \, \Delta t - \tfrac{1}{2} g \Delta t^2$$



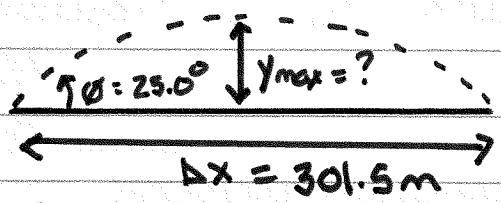
$$= (5.2 m/s)\sin 15^\circ (.80 s) - \tfrac{1}{2}(9.81 m/s^2)(.80 s)^2$$

$$= 1.1 m - 3.1 m$$

$$\Delta y = -2.0 m$$

Yes He will make it

2)



$g = 9.81\,m/s^2$

Given:

Find: $y_{max} = ?$

Note: y_{max} @ $\frac{\Delta t}{2}$!!

x-dir

$\Delta x = v_i \cos\phi\, \Delta t$ (? ?)

$\Delta t = \frac{\Delta x}{v_i \cos\phi}$

y-dir

$\Delta y = v_i \sin\phi\, \Delta t - \frac{1}{2} g \Delta t^2$

$\Delta y_{max} = v_i \sin\phi \frac{\Delta t}{2} - \frac{1}{2} g \left(\frac{\Delta t}{2}\right)^2$ (? ? ? ?) 3 unknowns!

Notes

$y_{max} \Rightarrow \frac{\Delta t}{2}$

use $\Delta y = 0$ @ 301.5 m ($\Delta y = 0$)

$\Delta y = v_i \sin\phi\, \Delta t - \frac{1}{2} g \Delta t^2$ (? ? ?)

$\Delta y = 0$

2 unknowns

$v_i = \frac{g \Delta t^2}{2 \sin\phi\, \Delta t}$

$v_i = \frac{g \Delta t}{2 \sin\phi} = \frac{g \Delta x}{2 v_i \sin\phi \cos\phi}$ sub in Δt

$v_i^2 = \frac{g \Delta x}{2 \sin\phi \cos\phi} = \frac{(9.81\,m/s^2)(301.5\,m)}{2 \sin(25.0) \cos(25.0)}$

$v_i = 62.1\,m/s$

* Velocity of Golf Ball leaving Club

$\Delta t = \frac{\Delta x}{v_i \cos\phi}$

$= \frac{301.5\,m}{62.1\,m/s \cos 25.0°}$

$\Delta t = 5.36\,s$

* Total time Golf Ball in Air

2) conti

y-dir

Now solve for y_{max} @ $\frac{\Delta t}{2}$

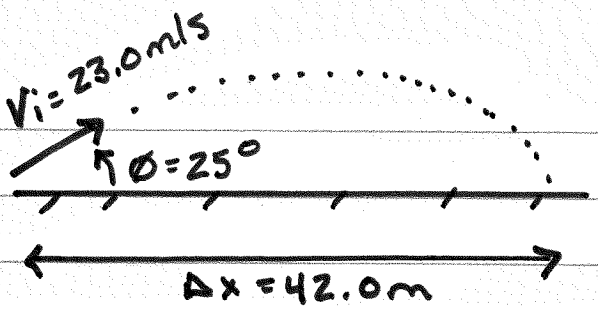
$$y_{max} = V_i \sin\theta \frac{\Delta t}{2} - \frac{1}{2} g \left(\frac{\Delta t}{2}\right)^2$$

$$= (62.1 \text{ m/s}) \sin(25.0) \frac{5.36 \text{ s}}{2} - \frac{1}{2}(9.81 \text{ m/s}^2)\left(\frac{5.36 \text{ s}}{2}\right)^2$$

$$= 70.3 \text{ m} - 35.2 \text{ m}$$

$$\boxed{y_{max} = 35.1 \text{ m}}$$

3) Given:



$g = 9.81\ m/s^2$

Find: $\Delta t = ?$ time in Air

$\Delta y_{max} = ?$

Soln:

x-dir

$\Delta x = v_i \cos\phi \, \Delta t$

$\Delta t = \dfrac{\Delta x}{v_i \cos\phi}$

$= \dfrac{(42.0\ m)}{(23.0\ m/s)\cos 25^\circ}$

$\boxed{\Delta t = 2.0\ s}$

y-dir

$\Delta y = v_i \sin\phi \, \Delta t - \frac{1}{2} g \Delta t^2$

$y_{max} \Rightarrow \frac{\Delta t}{2}$

$y_{max} = v_i \sin\phi \left(\frac{\Delta t}{2}\right) - \frac{1}{2} g \left(\frac{\Delta t}{2}\right)^2$

$= (23.0\ m/s)\sin 25 \left(\frac{2.0\ s}{2}\right) - \frac{1}{2}(9.81\ m/s^2)\left(\frac{2.0\ s}{2}\right)^2$

$= 9.7\ m - 4.9\ m$

$\boxed{y_{max} = 4.8\ m}$

OR

$v_{yf}^2 = v_i^2 (\sin\phi)^2 - 2g\Delta y$

$v_{yf} = 0$ @ y_{max}

$2g\Delta y = v_i^2 (\sin\phi)^2$

$\Delta y = \dfrac{v_i^2 (\sin\phi)^2}{2g}$

$= \dfrac{(23.0\ m/s)^2 (\sin 25)^2}{2(9.81\ m/s)}$

$\boxed{\Delta y = 4.8\ m}$